

REMARKS

Claims 11-13, 30, 31, 61, 62 and 66 have been amended. Claims 1-10, 17, 22, 24, 26, 27, 29, 32-57 and 68-71 are canceled. Claims 23, 25 and 28 are withdrawn. Claims 11-16, 18-21, 30, 31 and 58-67 are currently examined.

Claims 11, 12, 14, 15, 18, 20, 21, 30, 31, 58-62, 63, 64 and 66-71 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Merrill, U.S. Patent 7,132,724 (Merrill) in view of Descure, U.S. Patent No. 6,960,799 (Descure) and in further view of Merrill, U.S. Patent Publication No. 2002/0058353 (Merrill 2). This rejection is respectfully traversed.

Claims 68-71 have been canceled.

As amended, independent claim 11 recites an image pixel array in an imaging device, comprising, among other elements, "a first photosensor at or beneath a surface of a substrate; and a first filter having one or more layers of polysilicon or epitaxial silicon over the first photosensor and in contact with the substrate, the first filter connected to a ground terminal configured to drain charge from the first filter and having a first thickness and absorbing a majority of light at wavelengths shorter than a first wavelength and passing a majority of light at wavelengths longer than the first wavelength; the first photosensor receiving light passed by the first filter, absorbing a majority of light received at wavelengths shorter than a second wavelength and longer than the first wavelength, and passing a majority of light received at wavelengths longer than the second wavelength; a second photosensor at or beneath the surface of the substrate and laterally adjacent to the first photosensor; a second filter having one or more layers of polysilicon or epitaxial silicon over the second photosensor and in contact with the substrate, the second filter having a second thickness and absorbing a majority of light at wavelengths shorter than the second wavelength and passing a majority of light at wavelengths longer than the second wavelength; the second photosensor receiving light passed by the second filter, absorbing a majority of light received at wavelengths shorter than a third wavelength and longer than the second wavelength, and passing a majority of light received at wavelengths longer than the third wavelength; and a third photosensor

at or beneath the surface of the substrate and laterally adjacent to at least one of the first photosensor and the second photosensor; an insulating material in contact with the surface of the substrate directly above the third photosensor; the third photosensor absorbing light received at wavelengths shorter than the first wavelength and passing light received at wavelengths longer than the first wavelength.”

Amended claim 30 recites an imager integrated circuit, comprising, “a pixel array at the substrate’s surface, the pixel array comprising: first, second and third sets of pixels, each including a photodiode comprising a doped region of a first conductivity type at a same depth below the substrate’s surface; a first polysilicon filter having a first thickness over each of the photodiodes in the first set of pixels, the first polysilicon filter connected to a ground terminal configured to drain charge from the first polysilicon filter and absorbing a majority of light at wavelengths shorter than a first wavelength and passing a majority of light at wavelengths longer than the first wavelength; a second polysilicon filter having a second thickness different than the first thickness over each of said photodiodes in the second set of pixels, the second polysilicon filter absorbing a majority of light at wavelengths shorter than a second wavelength longer than the first wavelength and passing a majority of light at wavelengths longer than the second wavelength; an insulating material in contact with the surface of the substrate directly above the third photosensor; and readout circuitry that provides readout signals indicating a quantity of incident light absorbed in each of the photodiodes.”

Similarly, amended claim 31 recites an imager integrated circuit, comprising, “a pixel array at the substrate’s surface, the pixel array comprising: first, second and third sets of pixels, each including a photodiode comprising a doped region of a first conductivity type at a same depth below the substrate’s surface; a first crystal silicon filter having a first thickness over each of the photodiodes in the first set of pixels, the first crystal silicon filter connected to a ground potential configured to drain charge from the first crystal silicon filter and absorbing a majority of light at wavelengths shorter than a first wavelength and passing a majority of light at wavelengths longer than the first wavelength; a second crystal silicon filter having a second thickness different than the

first thickness over each of said photodiodes in the second set of pixels, the second crystal silicon filter absorbing a majority of light at wavelengths shorter than a second wavelength longer than the first wavelength and passing a majority of light at wavelengths longer than the second wavelength; an insulating material in contact with the surface of the substrate directly above the third photosensor; and readout circuitry that provides readout signals indicating a quantity of incident light absorbed in each of the photodiodes.”

As amended, independent claim 61 recites an image pixel array in an imaging device, comprising, a first photosensor at or beneath a surface of a substrate; and a first filter comprising one or both of polysilicon or epitaxial silicon over the first photosensor and substrate, the polysilicon or epitaxial silicon of the first filter connected to a ground terminal configured to drain charge from the first filter and having a first thickness and absorbing a majority of light at wavelengths shorter than a first wavelength and passing a majority of light at wavelengths longer than the first wavelength; the first photosensor receiving light passed by the first filter, absorbing a majority of light received at wavelengths shorter than a second wavelength and longer than the first wavelength, and passing a majority of light received at wavelengths longer than the second wavelength; a second photosensor at or beneath the surface of the substrate and laterally adjacent to the first photosensor; a second filter comprising of one or both of polysilicon or epitaxial silicon over the second photosensor and substrate, the polysilicon or epitaxial silicon of the second filter having a second thickness and absorbing a majority of light at wavelengths shorter than the second wavelength and passing a majority of light at wavelengths longer than the second wavelength; the second photosensor receiving light passed by the second filter, absorbing a majority of light received at wavelengths shorter than a third wavelength and longer than the second wavelength, and passing a majority of light received at wavelengths longer than the third wavelength; and a third photosensor at or beneath the surface of the substrate and laterally adjacent to at least one of the first photosensor and the second photosensor; an insulating material in contact with the surface of the substrate directly above the third photosensor; the third photosensor absorbing light received at wavelengths shorter than the first wavelength and passing light received at wavelengths longer than the first wavelength.”

Neither Merrill nor Descure, even when considered in combination, teach or suggest all limitations of independent claims 11, 30, 31 and 61. Merrill relates to a vertical-color-filter detector group. Merrill's detector group includes a red, a green and a blue detector, vertically stacked over one another and formed within an epitaxial layer over a substrate. Likewise, Merrill 2 relates to a vertical color filter detector group including at least six layers of alternating p and n-type doped regions that operate as a red, a green and a blue detector, vertically stacked over one another and formed within an epitaxial layer over a substrate. Merrill 2 at Abstract. Each detector is a doped region over a doped substrate. Merrill and Merrill 2 are silent about photosensors or photodiodes laterally adjacent to one another or formed at or below the surface of a substrate.

Descure relates to an array of photodiodes that are divided into three interleaved sub-arrays and is cited for teaching that photosensors are laterally adjacent to one another. According to Descure, however, there is a polysilicon layer 5 over all of the photodiodes 1G, 1R, 1B and in contact with the substrate 2 surface over the photodiode 1B. Descure at FIG. 2C. The polysilicon layer 5 serves as a capacitor gate and is tied to the same potential as the substrate 2 in order to increase the capacity of the photodiodes 1G, 1R, 1B. Descure at col. 2, lines 19-65. In contrast, according to the present claims, there is an insulating material in contact with the substrate surface directly above the third photosensor, which corresponds to Descure's photodiode 1B.

One skilled in the art would not be motivated to combine Merrill, Descure and Merrill 2 as suggested in the Office Action. The Office Action states that one skilled in the art would modify Merrill with Descure's teaching of laterally adjacent photodiodes in order to reduce the depth of the pixels within the array. This reasoning is not correct since Descure teaches many layers formed over each photosensor and there is nothing in any of the references that suggests a lateral arrangement would provide such an effect. Moreover, the Office Action specifically cites Merrill's placement of the photodiodes at specific depths within the epitaxial silicon against the present claims. Therefore, if one skilled in the art were motivated to reduce the depth of pixels within the array, it would not make sense to use Merrill's teachings. For at least these reasons, withdrawal of this rejection is respectfully requested.

Claims 13 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Merrill in view of Descure and in further view of Merrill 2 and Rhodes, U.S. Patent No. 6,815,743 (Rhodes). This rejection is respectfully traversed.

As discussed above, one skilled in the art would not be motivated to combine Merrill, Descure and Merrill 2 as suggested in the Office Action. Rhodes is cited for teaching a photosensor as a photogate, photodiode, photoconductor or other photosensitive elements (Office Action at 13) and does not supplement the deficiencies of Merrill, Descure and Merrill 2. For at least these reasons, withdrawal of this rejection is respectfully requested.


Claims 16 and 65 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Merrill in view of Descure and in further view of Merrill 2 and Randazzo, U.S. Patent No. 6,093,585 (Randazzo). This rejection is respectfully traversed.

As discussed above, one skilled in the art would not be motivated to combine Merrill, Descure and Merrill 2 as suggested in the Office Action. Randazzo is cited for teaching that a layer of TEOS can be formed over a polysilicon layer (Office Action at 14) and does not supplement the deficiencies of Merrill, Descure and Merrill 2. For at least these reasons, withdrawal of this rejection is respectfully requested.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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